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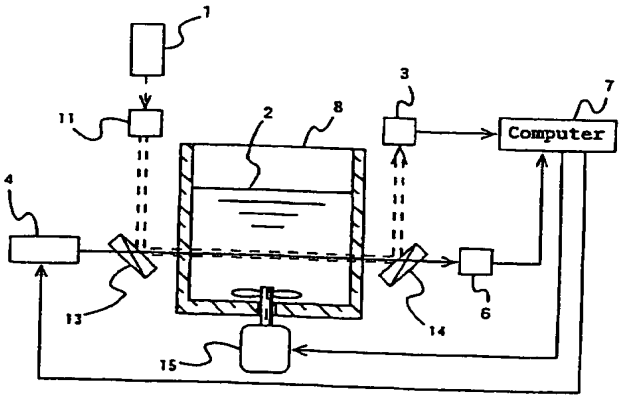
(54) Method for controlling an optical property measurement system

(57) The optical properties of a liquid sample (2) are measured by projecting a first light beam and analyzing the transmitted light. An additional light beam is projected along the path of the first light beam or along the periphery thereof to detect the presence or absence of bubbles and/or particles which may interfere with transmission of the first light beam, with detection being based on the intensity of the transmitted light of the second light beam. The bubbles and/or particles are removed when their presence is confirmed, e.g. by using a vibration table (9) to vibrate the sample cell (8), or a stirrer (15) to stir the liquid sample (2), or a wiper (16a) to clean the inner wall of the sample cell (8), or a lifter (30) to raise and lower the sample cell. This eliminates the need to detach the sample cell (2) from the optical system (1, 3, 4, 6) to introduce or excrete the sample and facilitates precise measurement of optical properties of the sample even when interfering substances are present in the sample cell.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to measurement of optical properties of a liquid sample, more particularly to a method for controlling an optical property measurement system.

[0002] When a sample is to be measured for its optical properties, then it should be placed in a sample cell so that light is transmitted therethrough. The sample cell is generally made of a glass or the like having a rectangular shape and has a structure where light is transmitted between a pair of transparent transmission planes.

[0003] In general, the sample cell has an opening at its upper part through which a preformulated sample is introduced into or excreted from the sample cell using a dropper, pipette, or syringe.

[0004] Exchange of sample is routinely performed for each sample cell. At that time, if bubbles or remaining undissolved particles of a solute are present on an optical path of light for measurement, they interfere with precise measurement, resulting in impaired measurement accuracy. Particularly, if the sample is introduced into such a sample cell that is fixed to an optical system or when a solute powder is dissolved in a solvent inside the sample cell to formulate a sample solution, there arise problems that bubbles are likely to generate during handling or the solute powder is likely to remain undissolved in the solvent. This makes it difficult to introduce the sample into or excrete it from the sample cell or to formulate a sample to be analyzed inside the sample cell, while the sample cell is installed inside the optical system.

[0005] Therefore, in order to prevent such problems, the sample cell is conventionally detached from the optical system to place the sample inside the sample cell and then install the sample containing sample cell in the optical system. Even if the sample solution is formulated inside the sample cell to measure the optical properties of the sample, the sample cell is installed in the optical system after formulation of sample solution.

[0006] As such, sample exchange and internal washing of the sample cell requires detachment of the sample cell from the optical system, rendering the operation much laborious and time-consuming. Furthermore, despite potential interference with the measurement of fine interfering substances, which are invisible with naked eyes, it is impossible to visually confirm all the interfering substances such as bubbles on the optical path without fail.

[0007] Moreover, when bubbles or particles are floating in the sample, for example, it is difficult to make exact estimation of a position of optical path when the sample cell is installed inside the optical system. The presence of undissolved solute represents that the liquid as the sample is not in an intended condition. As such, the presence of miscellaneous interfering substances renders it difficult to make precise measurement.

[0008] An object of the present invention is to address the above-mentioned problems and provide a controlling method of optical property measurement system which does not require detachment of the sample cell from the optical system for introduction and excretion of sample solution and facilitates accurate measurement of optical properties of the sample even in the presence of interfering substances such as bubbles inside the sample cell.

BRIEF SUMMARY OF THE INVENTION

[0009] The present invention provides a method for controlling optical property measurement system wherein optical properties of a liquid sample are measured by projecting first light to said liquid sample accommodated in a sample cell to analyze transmitted light therethrough, said method comprising the steps of:

projecting second light to a path of said first light projected to said liquid sample or in a periphery of said path of said first light to detect the presence or absence of bubbles and/or particles in said sample which may interfere with transmission of said first light projected to said sample, based on an intensity of transmitted light of said additional second light, and

vibrating said sample cell upon detection of the presence of bubbles and/or particles in said sample to remove said bubbles and/or particles from said path of said second light transmitted to said sample.

[0010] Further, the present invention provides a method for controlling optical property measurement system wherein optical properties of a liquid sample are measured by projecting first light to said liquid sample accommodated in a sample cell to analyze transmitted light therethrough, said method comprising the steps of:

projecting additional second light to a path of said first light projected to said liquid sample or in a periphery of said path of said light to detect the presence or absence of bubbles and/or particles in said sample which may interfere with transmission of said first light projected to said sample, based on an intensity of transmitted light of said additional second light, and

stirring said sample upon detection of the presence of bubbles and/or particles in said sample to remove said bubbles or particles from said path of said first light transmitted to said sample.

[0011] Further, the present invention provides a method for controlling optical property measurement